

National Aeronautics and Space Administration

STTR:
Small Business Technology Transfer
1998 Program Solicitation

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1. STTR Program Description

1.1 Introduction

The National Aeronautics and Space Administration (NASA) invites Small Business Concerns (SBC), as defined in section 2.3, in collaboration with a Research Institution (RI), as defined in section 2.2, to submit Phase-I proposals for cooperative research under this solicitation for the 1998 Small Business Technology Transfer (STTR) Program. The NASA STTR Program is designed as a vehicle for converting the nation's investment in research carried out by research institutions into new commercial technologies, in order to advance U.S. economic competitiveness and high-tech economic development.

Subject to the availability of funds, NASA plans to select about 30 proposals in July 1998 for negotiation of a Phase-I fixed-price contract. NASA anticipates that about 40 percent of these Phase-I projects will be selected for Phase-II development.

Proposals submitted in response to this solicitation must be jointly developed by a SBC and a RI, and must include all relevant documentation as required in Section 3.0. Not less than **40 percent** of the work (amount requested including cost sharing, less fee, if any) is to be performed by the SBC as the prime contractor, and not less than **30 percent** of the work is to be performed by the RI.

1.2 NASA STTR Program Concept

The NASA STTR Program is a three-year, three-phase program for meeting NASA program needs and for converting technology resident at a RI into the commercial marketplace through the entrepreneurial talents of a SBC. Proposals submitted in response to this solicitation must present a technology commercialization concept, which is applicable to the 1998 Research Topics and NASA Centers shown below.

- | | |
|---------------------|---------------------------------------|
| 1. Research Topics: | Scientific Research |
| NASA Center: | Goddard Space Flight Center |
| 2. Research Topics: | Human Operations in Space |
| NASA Center: | Johnson Space Center |
| 3. Research Topics: | Launch and Payload Processing Systems |
| NASA Center: | Kennedy Space Center |
| 4. Research Topics: | Structures and Materials |
| NASA Center: | Langley Research Center |
| 5. Research Topics: | Turbomachinery |
| NASA Center: | Lewis Research Center |
| 6. Research Topics: | Space Propulsion |
| NASA Center: | Marshall Space Flight Center |
| 7. Research Topics: | Rocket Propulsion Testing |
| NASA Center: | Stennis Space Center |

1.3 Features of the Three-Phase STTR Program

1.3.1 Legislative Basis. The legislative basis for this solicitation is the Small Business Research and Development Enhancement Act of 1992 (P.L. 102-564, October 28, 1992.) It amends Section 9 of the Small Business Act (15

U.S.C. 638). On August 10, 1993, the Small Business Administration (SBA) issued a Policy Directive for the general conduct of STTR Programs within the Federal Government.

1.3.2 Program Funding. The current law authorizes agencies participating in the STTR Program to expend with small business concerns not less than 0.15 percent of their extramural Research/Research and Development (R/R&D) budgets in FY 1998. The NASA STTR Program budget will therefore be about \$5.7M in FY 1998.

1.3.3 STTR Program Phases. The NASA STTR Program consists of the following three phases:

Phase-I The purpose of Phase-I is to determine the scientific, technical, and commercial merit and feasibility of the proposed cooperative R/R&D effort, and the quality of the small business concern's performance with a relatively small agency investment before consideration of further Federal support in Phase-II. NASA funding for each Phase-I contract is limited to \$100,000. Contractors will have up to 12 months to submit their final report. Successful completion of Phase-I objectives is a prerequisite to Phase-II selection.

Phase-II The object of Phase-II is to continue the R/R&D effort from Phase-I. Only SBCs awarded Phase-I contracts are eligible for Phase-II STTR funding agreements, and only at the Federal agency which awarded the Phase-I project. Awards will be based on the scientific, technical, and commercial merit and feasibility of the idea, as evidenced by the first phase, and by other relevant information. Funding for each Phase-II contract will be limited to \$500,000. Contractors will have up to 24 months to submit their final report.

Phase-III In Phase-III, the small business is expected to use non-Federal capital to pursue private sector applications of the R/R&D effort. In addition, NASA may award non-STTR funded follow-on contracts for products or services which meet its mission needs. The competition for Phase-I and Phase-II awards satisfies any competition requirement of the Competition in Contracting Act for subsequent NASA Phase-III contracting.

1.4 Program Eligibility

Each offeror submitting a proposal must qualify as a SBC for R/R&D purposes at the time of award. The SBC will submit a proposal for cooperative research and development as defined in Section 2.0 of this solicitation. For both Phase- I and Phase-II, the R/R&D work must be performed in the United States.

1.5 Access to NASA STTR Program Information

1.5.1 Questions About This Solicitation. To ensure fairness, questions relating to the intent and/or content of research topics in this solicitation cannot be answered during the Phase-I solicitation period beginning March 2, 1998 and ending May 14, 1998. Only questions requesting clarification of solicitation instructions and administrative matters will be answered.

1.5.2 Questions Regarding Proposal Status. Evaluation and selection of proposals will require about three months after the closing date of May 14, 1998. Except for a acknowledgment of proposal receipt (to be e-mail within 30 days of the closing date), information about proposal status will not be available until final selections are announced (Section 6.5).

1.5.3 Other Means of Contacting NASA STTR.

Each of the field centers have their own home pages including strategic planning and SBIR/STTR information. Please consult these home pages for more details on the technology requirements within the product areas.

- 1) **Help Line.** All inquiries, requests, and help-related questions may be made by :

telephone (301) 918-1980 between 8:30am-5:00pm (Mon-Fri, EST),
facsimile (301) 918-8154, or
email sttrsupport@lan.alliedtech.com

Regardless of the Help Line method used, the requestor must provide name and telephone number of person to contact, organization name and address, and the specific questions or requests.

- 2) NASA STTR General Information Contact.** Requests for general information about the NASA STTR Program should be mailed to:

National Aeronautics and Space Administration
Paul Mearns, Code 710.3
Goddard Space Flight Center
Greenbelt, MD 20771

2. Definitions

2.1 Cooperative Research and Development

For purposes of the NASA STTR Program, this means research and development conducted jointly by a SBC and a RI in which not less than 40 percent of the work (amount requested, including cost sharing if any, less fee if any) is performed by the SBC and not less than 30 percent of the work is performed by the RI.

2.2 Research Institution (RI)

A U.S. research institution is one that is: (1) a contractor-operated federally funded research and development center, as identified by the National Science Foundation in accordance with the government-wide Federal Acquisition Regulation as issued in section 35(c)(1) of the Office of Federal Procurement Policy Act (or any successor legislation thereto), or (2) a non-profit research institution as defined in section 4(5) of the Stevenson-Wydler Technology Innovation Act of 1980, or (3) a non-profit college or university.

2.3 Small Business Concern (SBC)

A SBC is one that, at the time of award of Phase-I and Phase-II funding agreements, meets the following criteria:

- (1) Is independently owned and operated, is not dominant in the field of operation in which it is proposing, has its principal place of business located in the United States, and is organized for profit; and
- (2) Is at least 51 percent owned by, or, in the case of a publicly owned business, at least 51 percent of its voting stock is owned by United States citizens or lawfully admitted permanent resident aliens; and
- (3) Has, including its affiliates, a number of employees not exceeding 500, and meets the other regulatory requirements found in 13 CFR Part 121. Business concerns, other than investment companies licensed, or state development companies qualifying under the Small Business Investment Act of 1958, 15 U.S.C. 661, et seq., are affiliates of one another when, either directly or indirectly, (a) one concern controls or has the power to control the other or (b) a third party controls or has the power to control both. Control can be exercised through common ownership, common management, and contractual relationships. The term "affiliates" is defined in greater detail in 13 CFR 121. The term "number of employees" is also defined in 13 CFR 121. Business concerns include, but are not limited to, any individual, partnership, corporation, joint venture, association, or cooperative.

2.4 Socially and Economically Disadvantaged SBC

A socially and economically disadvantaged SBC is: (1) one that is at least 51 percent owned by (i) an Indian tribe or a native Hawaiian organization or (ii) one or more individuals who are socially and economically disadvantaged individuals, and (2) whose management and daily business operations are controlled by one or more socially and economically disadvantaged individuals.

2.5 Socially and Economically Disadvantaged Individual

A member of any of the following groups:

- (1) Black Americans
- (2) Hispanic Americans
- (3) Native Americans
- (4) Asian-Pacific Americans
- (5) Subcontinent Asian Americans
- (6) Other groups designated from time to time by SBA to be socially disadvantaged; or
- (7) Any other individual found to be socially and economically disadvantaged by SBA pursuant to Section 8(a) of the Small Business Act, 15 U.S.C. 637(a).

2.6 Women-Owned SBC

A SBC that is at least 51 percent owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management.

2.7 Subcontract

Any agreement, other than one involving an employer-employee relationship, entered into by a Federal Government contractor calling for supplies or services required solely for the performance of the original contract. (Section 3.4.1, Part 10.)

3. Proposal Preparation Instructions and Requirements

3.1 Proposal Content

Each proposal submitted to the STTR Program must contain the following items in this order of presentation: (1) Proposal Cover Sheet (Form 9A); (2) Project Summary Sheet (Form 9B); (3) Technical Proposal; (4) Summary Budget Sheet (Form 9C); (5) Cooperative Agreement. Refer to Section 6.2 for requirements.

The STTR Phase-I proposal must provide sufficient information to convince NASA that the proposed SBC/RI cooperative effort represents a sound approach for converting technical information resident in the RI into a product or service that meets a need described in a solicitation research topic. It must also identify the eventual commercial application potential of the product or service and discuss how the SBC would bring it to market. Proposals directed toward systems studies, market research, and routine engineering design will be evaluated as non-responsive to this solicitation and will not be funded.

3.2 General Requirements

3.2.1 Page Limitation. As is specifically stated in Section 6.2, offerors are required to submit Phase-I proposals in both paper copy and electronic formats. The paper copy submitted by the offeror shall not exceed a total of **25 standard 8.5 x 11 inch pages**. All five proposal items required in Section 3.1 will be included within this total. Pages may be single or double spaced. Each page shall be numbered consecutively at the bottom. Samples, videotapes, slides, or other ancillary items are not required and will not be accepted. **If the paper copy of the proposal exceeds the 25-page limitation, then the entire proposal will be rejected as part of the administrative screening conducted prior to technical evaluation.**

3.2.2 Type Size. A font size of 10 point or larger is to be used for text and tables, except as legends on reduced drawings. **Proposals prepared in a font smaller than 10 point will be rejected.**

3.2.3 Brevity and Organization. The proposal should be direct, concise, and logically organized. Offerors are requested not to use the entire 25-page allowance unless necessary.

3.3 Proposal Cover Sheet and Project Summary

Note: The Proposal Cover Sheet and the Project Summary are public information, and the Government may disclose them. Do not include proprietary information on these forms.

3.3.1 Page 1: Proposal Cover Sheet (Form 9A). A copy of the Proposal Cover Sheet is provided in Section 9.0. Each offeror shall provide complete information for each item and submit the form as required in Section 6.0. The proposal title shall be concise and descriptive of the proposed product. The title should not use acronyms or words like "Development of" or "Study of." The NASA research topic title must not be used as the proposal title.

3.3.2 Page 2: Project Summary (Form 9B). A copy of the Project Summary Sheet is provided in Section 9.0. Each offeror shall provide complete information for each item and submit form 9B as required in Section 6.0. **Without revealing proprietary information and limited to 200 words,** the technical abstract section shall summarize the anticipated results and implications of the approach (both Phases I and II). Potential commercial applications of the technology should also be presented.

3.4 Technical Proposal

3.4.1 The Technical Proposal shall not contain any budget data and **must consist of all eleven parts in the following order.** (Note: Parts that are not applicable must be included and marked "Not Applicable.")

Part 1: Table of Contents. Page 3 of the proposal shall begin with a brief table of contents indicating the page numbers of each of the sections of the proposal. The rest of the pages can be devoted to the Technical Proposal.

Part 2: Identification and Significance of the Technology or Intellectual Property. The first paragraph of Part 1 shall contain (1) **a clear and succinct statement of the specific technology or intellectual property resident at the RI** that is the basis for the proposed cooperative effort, and (2) a brief explanation of how this effort is relevant to meeting the need described in the applicable Research Topic contained in this solicitation. Additional paragraphs in Part 2 should provide appropriate background and elaboration to explain why the proposed cooperative effort should be supported.

Part 3: Phase-I Technical Objectives. The offeror shall state the specific objectives of the Phase-I effort and the technical questions that must be answered during Phase-I to determine the feasibility of the further research and development to convert the intellectual property resident at the RI into products or services that benefit the specified research topic and have potential commercial application.

Part 4: Phase-I Work Plan. The Phase-I Work Plan must be complete and self-contained and shall describe the Phase-I R/R&D required to answer the feasibility questions stated in Part 3. The work plan shall indicate, in detail, what will be done and where the work will be carried out. The methods planned to achieve each objective or task should be discussed in detail. Schedules (Gantt charts, or other suitable scheduled task displays), task descriptions and assignments, resource allocations, and planned accomplishments, including project milestones, shall be included. The work plan will specifically address the percentage and type of work to be performed by the SBC and by the RI, and provide evidence that the SBC will exercise management direction and control of the performance of the STTR effort, including situations in which Principal Investigator may be an employee of the RI.

Part 5: Related R/R&D and Bibliography of Related Work. The section should include a clear statement of the offerors awareness of key recent developments by others in the specific subject area. It should include any significant R&D activities, which are directly related to the proposal, that have been conducted by the SBC, the RI and the Principal Investigator or Project Manager (PI/PM). Any other planned R&D related to the proposed project should also be described. At the offeror's option, this section may include concise bibliographic references in support of the proposal if they are confined to activities directly related to the proposed work.

Part 6: Relationship with Phase-II. The offeror shall (1) state the anticipated results of the proposed R&D effort if the project is successful (Phases-I and -II) and (2) discuss the significance of the Phase-I effort in providing a foundation for the Phase-II R&D effort.

Part 7: Commercial Applications Potential. The offeror shall describe whether and by what means the proposed project appears to have potential (1) commercial application and (2) use by the Federal government.

Part 8: Company Information and Facilities. This section shall provide adequate information to allow the evaluators to assess the ability of the SBC/RI team to carry out the proposed Phase-I and projected Phase-II and Phase-III activities. The offeror should describe the relevant facilities and equipment currently available, and those to be purchased, in order to adequately support the team's proposed activities. **NASA will not fund the acquisition of equipment, instrumentation, or facilities under STTR Phase-I contracts as a direct cost (Section 5.14).** The capability of the offeror to perform the proposed activities and bring a resulting product or service to market must be indicated. Qualifications of the offeror and its principals in marketing related products or services or in raising capital should be presented.

Part 9: Key Personnel and Other Staff. The offeror shall identify the key employees to be committed to Phase-I activities. Key personnel are the Principal Investigator or Project Manager (PI/PM) and other individuals whose expertise is essential to the success of the project. Substitution of the PI/PM or other personnel designated as "key" at any time may be made only with the written consent of the NASA contracting officer. Substitution of a "key" person will be judged against the education and experience of the key person approved at contract award.

The PI/PM is presumed to be essential to the success of an STTR project. The PI/PM must have the technical competence and authority to plan and guide the proposed R/R&D effort. Co-PI's or Co-PM's are not acceptable. NASA assumes that the PI normally will be employed either by the SBC or the RI, and will make a substantial commitment to the project. If the PI is not an employee of the SBC, the offeror must describe the management process to ensure SBC control of the project.

The proposal must state the time and effort planned for the key personnel and their organizational affiliation (SBC, RI, or other). Information on the education, experience, and any directly related publications of key personnel is required. Offerors are requested to avoid extensive vitae and publication lists not pertinent to the proposed R/R&D. This section shall indicate the extent to which other proposals recently submitted or planned for submission in 1998, and existing projects, commit key persons' time concurrently with this proposed activity. The qualifications of other staff who will make significant contributions to the project, but who are not considered key personnel, should also be described.

Part 10: Subcontracts and Consultants. The SBC/RI team may establish business arrangements with other entities or individuals provided such arrangements do not exceed 30 percent of the work (amount requested including cost sharing if any, less fee, if any) in both Phases-I & -II. The offeror must describe all subcontracting or other business arrangements, and identify the relevant organizations and/or individuals with whom arrangements are planned.

The expertise to be provided by entities other than the SBC and RI must be described in detail, as well as the functions, services, number of hours and labor rates, and extent of the effort to be provided. The proposal must include certifications by each participating organization and individual consultant that they will be available at the times required for the purposes and extent of effort described in the proposal. *Failure to provide subcontractor/consultant certifications may result in rejection of the entire proposal.*

Part 11: Similar Proposals or Awards. A firm may elect to submit proposals for essentially equivalent work under other Federal program solicitations, or may have received other Federal awards for essentially equivalent work. In these cases, a statement must be included in each such proposal indicating:

- (1) The name and address of the agencies to which proposals have been or will be submitted, or from which awards have been received.
- (2) Date of proposal submission or date of award.
- (3) Title, number, and date of Solicitations (if known) under which proposals have been or will be submitted, or awards received.

- (4) The specific research topic for each proposal submitted or award received.
- (5) Titles of the proposed projects.
- (6) Name and title of the Principal Investigator or Project Manager for each proposal that has been or will be submitted or award received.

It is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to NASA before award.

3.5 Proposed Budget

3.5.1 Summary Budget (Form 9C). A copy of the Summary Budget Sheet is provided in Section 9.0. Each offeror shall provide complete information for each item and submit the form as required in Section 6.0. Sufficient information shall be submitted to show how the offeror plans to use the requested funds, and enable NASA to determine whether the proposed budget is realistic and reasonable. Items on the form that do not apply to the proposed project may be omitted.

3.5.2 Property. NASA will not fund the purchase of instrumentation, equipment, or facility acquisition as a direct cost under Phase-I (Section 5.14). However, any purchases of products required for R/R&D under an STTR contract using NASA funds should be American-made.

3.5.3 Travel. Use of STTR funds for travel must be reasonable and essential for the purposes of Phase-I.

3.5.4 Profit. Unless prohibited by statute, a reasonable profit or fee should be included in the proposed budget (Section 5.9).

3.5.5 Cost Sharing. (Section 5.8)

3.6 Cooperative Agreement

The Cooperative Agreement (not to be confused with the Allocation of Rights Agreement) shall be a single page document (see the enclosed Model Cooperative Agreement for an example) which contains a statement to NASA that the SBC, the RI, and any applicable subcontractors and/or consultants have agreed to cooperate on the proposed project, if and when the project is selected for funding. The Cooperative Agreement shall be submitted in accordance with Section 6.0.

4. Method of Selection and Evaluation Criteria

4.1 Phase-I

4.1.1 Phase-I Evaluation Process. Proposals judged to be responsive to this solicitation will be evaluated on a competitive basis. Proposals will be first screened for compliance with the administrative requirements of the solicitation. Those that are accepted will then be reviewed to determine whether they respond to the topic chosen by the offeror. All evaluations will be based upon the criteria specified in Section 4.1.2.

Evaluators rely only on information contained in the proposals. Offerors should not assume that evaluators are acquainted with the firm, the research institution, key individuals, or with any experiments or other information. Any pertinent references or publications should be noted in Part 5 of the technical proposal.

4.1.2 Phase-I Evaluation Criteria. Each proposal will be judged and scored on its own merits using the factors described below.

Factor 1. Scientific/technical merit and feasibility of the proposed cooperative R/R&D effort; the relevance of the intellectual property to meeting a NASA need described in a technical topic contained in

this solicitation; and the specific objectives, approaches, and plans for converting the intellectual property into useful products or services.

Factor 2. Experience and qualifications of the SBC offeror, research institution, principal investigator or project manager, key personnel, staff, consultants and subcontractors, if any, and the adequacy of available or obtainable instrumentation and facilities for the project. Experience and qualifications will be judged in terms their relevance to the stated objectives of the offeror's proposed cooperative R/R&D effort.

Factor 3. Effectiveness of the proposed organization and plans for accomplishing the goals of the cooperative R/R&D effort, including definition of responsibilities for joint work plans; effective use of assets by the offeror and research institution; the budget; and schedules for meeting the Phase-I objectives. Of special importance is the demonstration of the offeror's ability to organize efforts for effective conversion of intellectual property provided by the research institution into products or services of value to NASA and the commercial marketplace.

Factor 4. Commercial merit and feasibility of potential commercial applications in the private sector or for use by the Federal Government.

Scoring of Factors and Weighting: The sum of the scores for factors 1, 2 and 3 constitutes the numerical value for the **Technical Merit** of a proposal. Factor 1 is about twice the weight of factors 2 and 3. Only proposals of high technical merit will be evaluated for their commercial merit and feasibility. The score for **Commercial Merit** will be in the form of an adjectival rating (Excellent, Very Good, Average, Below Average, Poor, Insufficient Data).

4.1.3 Selection After a proposal is evaluated, it will be ranked relative to all others evaluated under the same topic. Those considered suitable for selection will be recommended for further consideration by the NASA Center STTR Committee. The committee will prepare final recommendations for selection based on proposal merit, program priorities, and mission needs. These recommendations will then be forwarded to the selection official at NASA Headquarters. Selection decisions will consider the recommendations from all Centers, overall NASA priorities, and program balance.

Firms selected for negotiations that may lead to an award will be notified by mail. The list of selections will also be available electronically via the Internet and by public announcement. The notification letters will identify the Contracting Officer at the NASA Center responsible for negotiating a Phase-I contract.

4.1.4 Contracting Fixed-price contracts will be issued for Phase-I. Simplified contract documentation is employed. SBCs selected for negotiation of contract awards can reduce processing time by examining the procurement documents, furnishing the contracting officer with signed representations and certifications, and indicating any contract terms to be negotiated or agreement with the contract terms. NASA will make the Phase-I model contract and other documents available to the public on the NASA SBIR/STTR home page (<http://sbir.nasa.gov>) at the time of selection announcement. **From the time of proposal selection until the award of a contract, only the contracting officer is authorized to commit the Government, and all communications must be through the Contracting Officer or the Contracting Officer's Technical Representative as indicated in writing.**

4.1.5 Allocation of Rights Agreement. After being selected for Phase-I contract negotiations, but before the contract starts, the offeror shall, if requested, provide to the Contracting Officer at the managing NASA Center, a completed **Allocation of Rights Agreement (ARA)**, which has been signed by authorized representatives of the SBC, RI and subcontractors and consultants, as applicable. The ARA shall state the allocation of intellectual property rights with respect to the proposed STTR activity and planned follow-on research, development and/or commercialization.

4.2 Phase-II

Selection of Phase-II proposals will be based on evaluation factors listed in Section 4.2.3 and other considerations as discussed in Section 4.2.4.

4.2.1 Phase-II Proposals. The STTR Phase-I contract will serve as the request for proposal (RFP) for an STTR Phase-II follow-on contract except (1) when NASA notifies the contractor that the area or topic of R/R&D no longer has high priority in the agency, or (2) when NASA notifies the contractor that the Phase-I R/R&D results are not worthy of continuation. Submission of a Phase-II proposal is strictly voluntary, and NASA assumes no responsibility for proposal preparation cost. NASA is not obligated to fund any specific Phase-II proposals (Section 1.1).

Phase-II proposals are more comprehensive than those required for Phase-I. They shall be submitted no later than the end of the Phase-I contract performance term; however, contractors are encouraged to submit their proposals and the Phase-I final reports as early as possible. Final selections will be based upon the evaluation of the Phase-I final report and the Phase-II proposal.

4.2.2 Phase-II Proposal Contents. Phase-II proposals shall be addressed in the following "Part" order listed. Failure to include any requested information in the proposal may make it non-responsive to the RFP.

Part 1: Cover Page. (Form provided by NASA)

Part 2: Project Summary. (Form provided by NASA)

Part 3: Table of Contents.

Part 4: Results of the Phase-I Project. Briefly describe how Phase-I has proven the feasibility of the innovation, provided a rationale for both NASA and commercial applications, and demonstrated the ability of the offeror to conduct the R/R&D.

Part 5: Phase-II Technical Objectives, Approach, and Work Plan. Define the specific technical objectives of the Phase-II research and technical approach to meet these objectives; and provide a work plan defining specific tasks, performance schedules, milestones, and deliverables.

Part 6: Company Information. Describe the capability of the firm to carry out Phase-II and Phase-III activities including its organization, operations, number of employees, R/R&D capabilities, and experience relevant to the work proposed.

Part 7: Facilities and Equipment. Discuss requirements for and the availability of equipment, instrumentation, and facilities required for Phase-II.

Part 8: Key Personnel. Identify the key personnel for the project, confirm their specific availability for Phase-II, and discuss their qualifications in terms of education, work experience, and accomplishments that are relevant to the project.

Part 9: Consultants and Subcontracts. Describe in detail any subcontracting, consultant, or other business arrangements and provide written evidence of their availability for the project. For Phase-II, **a minimum of 40% of the work** must be performed by the proposing small business concern unless approved in writing by the contracting officer.

Part 10: Commercialization and Phase-III Plans. Describe plans for commercialization (Phase-III) in terms of each of the following areas:

- (1) Product or Service Commercial Feasibility
- (2) Market Feasibility and Competition
- (3) Strategic Relevance to the Offeror
- (4) Current and Proposed Personnel and Organizational Structure relevant to bringing innovative technology to commercial application.
- (5) Production and Operations, Plans and Dates, and
- (6) Financial Resources and Planning

Part 11: Capital Commitments Supporting Phases II and III. Describe and document capital commitments from non-STTR sources or from internal funds for pursuit of Phase-II and Phase-III. Potential Phase-II contractors are strongly urged to obtain valid non-STTR funding support commitments for (1) follow-on Phase-III activities and (2) additional support of Phase-II from parties other than the proposing firm. Valid funding support commitments must provide that a specific, substantial amount will be made available to the firm to pursue the stated Phase-II and/or -III objectives. They must indicate the source, date, and conditions or contingencies under which the funds will be made available. Alternatively, self-commitments of the same type and magnitude that are required from outside sources can be considered. If Phase-III will be funded internally, offerors should describe their financial position.

Evidence of funding support commitments from outside parties must be provided in writing to the proposing entity, and should accompany the Phase-II proposal. Letters of commitment should specify funding commitments, availability, other resources to be provided, and any contingent conditions. Expressions of technical interest by such parties in the Phase-II research or of potential future financial support are insufficient and will not be accepted as support commitments by NASA.

Part 12: Related R/R&D. Describe R/R&D related to the proposed work and affirm that the proposed objectives have not already been achieved and that the same development is not presently being pursued elsewhere under contract to the government.

Part 13: Proposal Pricing. Special instructions for pricing the Phase-II proposal will be provided in the Phase-I contract and may be provided in writing by the contracting officer.

4.2.3 Phase-II Evaluation Factors. The evaluation of Phase-II proposals that may result from Phase-I contracts awarded under this solicitation will apply the following factors:

Factor 1. Scientific/technical merit and feasibility of the proposed R/R&D, with special emphasis on its innovativeness, originality, and technical payoff potential if successful, including the degree to which Phase-I objectives were met, the feasibility of the innovation, and whether the Phase-I results indicate a Phase-II project is appropriate.

Factor 2. Future importance and eventual value of the product, process, or technology results to the NASA mission.

Factor 3. Capability of the Small Business Concern. NASA will assess the capability of the concern to conduct Phase-II based on (a) the validity of the project plans for achieving the stated goals, (b) the qualifications and ability of the project team (Principal Investigator/Project Manager, company staff, consultants and subcontractors) relative to the proposed research, and (c) the availability of any required equipment and facilities.

Factor 4. Commercial Potential. Consideration will be given to the commercial potential of the technology; demonstrated commercial intent of the offeror; and capability of the offeror to bring successfully developed technology to commercial application

In applying these commercial criteria, NASA will assess proposal information in terms of credibility, objectivity, reasonableness of key assumptions, independent corroborating evidence, internal consistency,

demonstrated awareness of key risk areas and critical business, and other indicators of sound business analysis and judgment.

4.2.4 Evaluation and Selection. Factors 1, 2, and 3 will be scored numerically. Factors 2 and 3 are of equal importance, while Factor 1 is more important than either 2 or 3. The sum of the scores for Factors 1, 2, and 3 will comprise the Total Technical Merit score for a Phase-II proposal. Proposals receiving high numerical scores will be evaluated and rated for their commercial potential using the criteria listed in Factor 4 and by applying the same adjectival ratings as set forth for Phase-I proposals (Section 4.1.2).

Each NASA Installation managing Phase-I projects will use these factors to evaluate the Phase-II proposals it receives that are responsive to the Phase-II RFP. **Those found to be responsive will be evaluated in greater depth by a peer review process that may include reviewers from government, academia, and private industry.** The Center's STTR Committee will recommend proposals for award to the STTR Source Selection Official. Final selections by the STTR Source Selection Official will be based on recommendations from all Centers; NASA Headquarters Program Offices' assessments of project value to NASA programs and plans; and any other evaluations or assessments (particularly of commercial potential) that may become available to the Source Selection Official.

4.3 Debriefing of Unsuccessful Offerors

After Phase-I and Phase-II selection decisions have been announced, a proposal critique (debriefing) for an unsuccessful offeror will be available to the offeror's corporate official or designee. Only written requests will be honored; telephone requests for debriefings will not be accepted. **Debriefings are not opportunities to reopen selection decisions.** They are intended to acquaint the offeror with perceived strengths and weaknesses of the proposal and perhaps identify constructive future action by the offeror. Debriefings may also be available electronically through Internet access (Section 6.3).

Debriefings will not disclose the identity of the proposal evaluators nor provide proposal scores, proposal rankings in the competition, or the content of, and comparisons with other proposals with which they were in competition.

4.3.1 Phase-I Debriefings. For Phase-I proposals, all requests for debriefing must be in writing to the STTR Program Manager at NASA Goddard Space Flight Center and be post-marked within 60 days after notification has been mailed to the offeror. Late requests will not be honored.

4.3.2 Phase-II Debriefings. To request debriefings on Phase-II proposals, offerors must write to the Contracting Officer at the appropriate NASA Center (not the STTR Program Manager) within 60 days after notification was mailed to the offeror that their proposal was not selected. Late requests will not be honored.

5. Considerations

5.1 Award

Both Phase-I and Phase-II awards are subject to availability of funds. NASA has no obligation to make any specific number of Phase-I or Phase-II awards based on this solicitation, and may elect to make several or no awards in any specific technical topic. In 1998, NASA expects to announce the selection of approximately 30 proposals for negotiation of fixed-price Phase-I contracts with values not exceeding \$100,000. Following contract negotiations and awards, Phase-I contractors will have twelve months to complete their proposed Phase-I programs and to submit their final report.

About 40 percent of the successfully completed Phase-I projects resulting from this solicitation may be selected for Phase-II continuations based on the results of Phase-I activities and competitive evaluations of Phase-II proposals. Phase-II funding agreements will be fixed-price contracts with performance periods not exceeding 24 months and funding not exceeding \$500,000.

5.2 Phase-I Reporting

A final report on the Phase-I must be submitted to NASA (paper copies and an electronic version) upon completion of the Phase-I R/R&D effort in accordance with Phase-I contract provisions. It shall elaborate the project objectives, work carried out, results obtained, and assessments of technical merit and feasibility. The final report shall include a single page project summary as the first page, in a format provided in the Phase-I contract, identifying the purpose of the R/R&D effort and describing the R/R&D effort, findings, and results, including the degree to which the Phase-I objectives were achieved, and whether the results justify Phase-II continuation. The potential applications of the project results in Phase-III either for NASA or commercial purposes shall also be described. The project summary is to be submitted without restriction for NASA publication. Language used in the Phase-I report may be used verbatim in the Phase-II proposal.

When the invoice is submitted at project mid-point (Section 5.3), an interim report is required. This report shall document progress made on the project and activities required for completion to provide NASA the basis for determining whether the payment is warranted.

5.3 Payment Schedule

Payments in Phase-I can be authorized as follows: one-third at the time of award, one-third at project mid-point, and the remainder upon acceptance of the final report by NASA. The first two payments will be made 30 days after receipt of valid invoices. The final payment will be made 30 days after acceptance of the final report and other deliverables as required by the contract. Electronic funds transfer will be employed and offerors will be required to submit account data if selected for contract negotiations.

5.4 Treatment and Protection of Proposal Information

In the evaluation and handling of proposals, NASA will make every effort to protect the proposals and their evaluations from unauthorized disclosure. **NASA does not accept STTR proposals that contain classified information.**

5.4.1 Proprietary Information. It is NASA's policy to use information (data) included in proposals for evaluation purposes only. Public release of information in any proposal submitted will be subject to existing statutory and regulatory requirements. If proprietary information consisting of a trade secret, proprietary commercial or financial information, or private personal information is provided in an STTR proposal, NASA will treat it in confidence to the extent permitted by law, provided this information is clearly marked by the offeror with the term "confidential proprietary information" and provided the following legend appears on the title page of the proposal follows:

For any purpose other than to evaluate the proposal, this data shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed in whole or in part, provided that if a funding agreement is awarded to the offeror as a result of or in connection with the submission of this data, the Government shall have the right to duplicate, use or disclose the data to the extent provided in the funding agreement. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction are contained on pages _____ of this proposal.

NASA recommends that offerors not include proprietary information in their proposals. **Do not label the entire proposal proprietary.** Form 9B, Project Summary, should not contain proprietary information.

5.4.2 Non-NASA Reviewers. In addition to Government personnel, NASA, at its discretion and in accordance with 18 15.413-2 of the NASA FAR Supplement, may utilize reviewers from outside the Government in the proposal review process. Any decision to obtain outside evaluation shall take into consideration requirements for the avoidance of organizational or personal conflicts of interest and the competitive relationship, if any, between the prospective contractor and associated business entities and the prospective outside evaluator. Any such evaluation

will be under agreement with the evaluator that the information (data) contained in the proposal will be used only for evaluation purposes and will not be further disclosed.

5.4.3 Release of Proposal Information. By submission of a proposal, the offeror agrees to permit the Government to publicly disclose the information contained in the Cover Sheet and Project Summary. Other proposal information (data) is considered to be the property of the offeror, and NASA will protect it from public disclosure to the extent permitted by law.

5.4.4 Final Disposition of Proposals. The Government retains ownership of proposals accepted for evaluation, and they will not be returned to the offeror. Copies of all evaluated Phase-I proposals will be retained for one year after the Phase-I selections have been made, after which time unsuccessful proposals may be destroyed.

5.5 Government Rights to Data Developed Under STTR Contracts

5.5.1. Non-Proprietary Data. Some data of a general nature are to be furnished to NASA without restriction (i.e., with unlimited rights) and may be published by NASA. These data will normally be limited to the project summaries accompanying any periodic progress reports and the final reports required to be submitted (see Section 5.2). The requirement for them will be specifically set forth in any contract resulting from this Solicitation.

5.5.2 Proprietary Data. When data that is required to be delivered under a STTR contract qualifies as "proprietary," *i.e.*, either data developed at private expense that embody trade secrets or are commercial or financial and confidential or privileged, or computer software developed at private expense that is a trade secret, the Contractor, if the contractor desires to continue protection of such proprietary data, shall not deliver such data to the Government, but instead shall deliver form, fit, and function data.

5.5.3 Non-Disclosure Period. The Government, for a period of 4 years from acceptance of all items to be delivered under a STTR contract, shall use STTR data, *i.e.*, data first produced by the Contractor in performance of the contract where such data are not generally known, and which data without obligation as to its confidentiality have not been made available to others by the Contractor or are not already available to the Government, agrees to use these data for Government purposes, and they shall not be disclosed outside the Government (including disclosure for procurement purposes) during the 4 year period without permission of the Contractor, except that such data may be disclosed for use by support Contractors under an obligation of confidentiality. After the 4 year period the Government has a royalty-free license to use, and to authorize others to use on its behalf, these data for Government purposes, but the Government is relieved of all disclosure prohibitions and assumes no liability for unauthorized use by third parties.

5.6 Copyrights

Subject to certain licenses granted by the Contractor to the Government, the Contractor receives copyright to any data first produced by the Contractor in the performance of a STTR contract.

5.7 Patents

The Contractor may normally elect title to any inventions made in the performance of a STTR contract. The Government receives a nonexclusive license to practice or have practiced for or on behalf of the Government each such invention throughout the world. To the extent authorized by 35 U.S.C. 205, the Government will not make public any information disclosing such inventions for a reasonable time to allow the Contractor to file a patent application.

5.8 Cost Sharing

Cost sharing is permitted for proposals under this solicitation. However, cost sharing is not required, nor will it be a factor in proposal evaluation. If included, cost sharing should be shown in the summary budget but not included in items labeled "AMOUNT REQUESTED." **If cost sharing is proposed, then these added funds shall be included in the 40/30 work percentage distribution stated in Section 1.1 and reflected in the Summary Budget (Form 9C).**

5.9 Profit or Fee

Both Phase-I and Phase-II STTR contracts shall include a reasonable profit except where cost-sharing is proposed. No profit will be paid under cost-sharing contracts. The reasonableness of a proposed profit is examined by the Contracting Officer during contract negotiations.

5.10 Joint Ventures and Limited Partnerships

Proposals may be submitted in the name of a joint venture or a limited partnership provided the entity qualifies as a small business concern in accordance with the definition in Section 2.3.

5.11 Similar Proposals and Prior Work

If an award is made pursuant to a proposal submitted under this Program Solicitation, the firm will be required to certify that it has not previously been paid nor is currently being paid for essentially equivalent work by any agency of the Federal government. Failure to acknowledge or report similar or duplicate efforts can lead to the termination of contracts or other actions.

5.12 Contractor Commitments

Upon award of a contract, the contractor will be required to make certain legal commitments through acceptance of numerous clauses in the Phase-I contract. The outline that follows illustrates the types of clauses that will be included in the Phase-I contract. This is not a complete list of clauses to be included in Phase-I contracts, nor does it contain specific wording of these clauses. Copies of complete provisions will be made available prior to contract negotiations (Section 4.2).

5.12.1 Standards of Work. Work performed under the contract must conform to high professional standards. Analyses, equipment, and components for use by NASA will require special consideration to satisfy the stringent safety and reliability requirements imposed in aerospace applications.

5.12.2 Inspection. Work performed under the contract is subject to Government inspection and evaluation at all reasonable times.

5.12.3 Examination of Records. The Comptroller General (or a duly authorized representative) shall have the right to examine any pertinent records of the contractor involving transactions related to the contract.

5.12.4 Default. The Government may terminate the contract if the contractor fails to perform the contracted work.

5.12.5 Termination for Convenience. The contract may be terminated by the Government at any time if it deems termination to be in its best interest, in which case the contractor will be compensated for work performed and for reasonable termination costs.

5.12.6 Disputes. Any dispute concerning the contract that cannot be resolved by mutual agreement shall be decided by the contracting officer with right of appeal.

5.12.7 Contract Work Hours. The contractor may not require a non-exempt employee to work more than 40 hours in a work week unless the employee is paid for overtime.

5.12.8 Equal Opportunity. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, age, sex, or national origin.

5.12.9 Affirmative Action for Veterans. The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era.

5.12.10 Affirmative Action for Handicapped. The contractor will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.

5.12.11 Officials Not to Benefit. No member of or delegate to Congress shall benefit from the STTR contract.

5.12.12 Covenant Against Contingent Fees. No person or agency has been employed to solicit or secure the contract upon an understanding for compensation except bona fide employees or commercial agencies maintained by the contractor for the purpose of securing business.

5.12.13 Gratuities. The contract may be terminated by the Government if any gratuities have been offered to any representative of the Government to secure the contract.

5.12.14 Patent Infringement. The contractor shall report to NASA each notice or claim of patent infringement based on the performance of the contract.

5.12.15 American-Made Equipment and Products. Equipment or products purchased under an STTR contract must be American-made whenever possible.

5.13 Additional Information

5.13.1 Precedence of Contract over Solicitation. This solicitation reflects current planning. If there is any inconsistency between the information contained herein and the terms of any resulting STTR contract, the terms of the contract are controlling.

5.13.2 Evidence of Contractor Responsibility. Before award of an STTR contract, the Government may request the offeror to submit certain organizational, management, personnel, and financial information to establish responsibility of the offeror.

5.13.3 Limitations on Awards. This Solicitation is not an offer by the Government to make any specific number of awards under either Phase-I or Phase-II. NASA is not responsible for any monies expended by the offeror before award of any contract resulting from this Solicitation. Awards under this Program Solicitation are contingent upon the availability of funds.

5.13.4 Classified Proposals. NASA will not accept proposals containing classified information.

5.13.5 Unsolicited Proposals. Unsolicited proposals will not be accepted under the STTR program in either Phase-I or Phase-II.

5.14 Property

In accordance with the Federal Acquisition Regulations (FAR) Part 45, it is NASA's policy not to provide facilities (capital equipment, tooling, test and computer facilities, etc.) for the performance of work under contract. The presumption is that an offeror will furnish their own facilities to perform the proposed work as an indirect cost to the contract. Special tooling required for a project may be allowed as a direct cost.

When an offeror cannot furnish their own facilities to perform required tasks, an offeror may propose to acquire the use of commercially available facilities. Rental or lease costs may be considered as direct costs as part of the total funding for the project.

If unique requirements force an offeror to acquire facilities under a NASA contract, they will be purchased as Government furnished equipment (GFE) and titled to the Government.

An offeror may propose the use of unique or one-of-a-kind NASA facilities if essential for the research. Their availability, however, cannot always be guaranteed, and non-availability may lead to non-selection. Offerors

requiring a NASA facility must clearly describe why use of such facilities will accelerate Phase-III commercialization. Should an offeror propose the use of unique or one-of-a-kind NASA facilities, an agreement with the responsible installation is required and costs for their use will be determined by the installation. These costs may be chargeable in accordance with the government property clause of the contract (Section 4.1.4).

6. Submission of Proposals

6.1 The Submission Process

6.1.1 Submission Requirements

NASA is in the process of converting to a completely electronic process for management of the STTR and SBIR programs. This management approach requires that a proposing firm have Internet access via the World Wide Web, and an E-mail address. The advantages to the firm are:

1. Faster, cheaper, simpler submission of Phase-I and Phase-I proposals.
2. Faster and better communication among awardee firms, contracting officers, and contracting officer's technical representatives (COTRs) will expedite Phase-I and Phase-II contract negotiation, administration and close-out.
3. Faster and better communication between Phase-I and Phase-II awardee firms and NASA will facilitate success story collection, marketing surveys, intellectual property (i.e. patent) applications, and non-NASA marketing of resultant products.

6.1.2 What Needs to Be Submitted

A proposal submission is comprised of three parts:

1. **Electronic Technical Proposal Submission.** (Section 6.2) The Electronic Technical Proposal must be submitted either with the Internet Submission (Section 6.3) or on electronic media with the Postal Submission (Section 6.4).
2. **Internet Form Submission** of Proposal Cover Sheet (Form 9A), Project Summary Sheet (Form 9B), and Summary Budget Sheet (Form 9C) (Section 6.3.) is required
3. **Postal Submission** of the original signed proposal plus three copies. (Section 6.4.)

Firms not able to obtain Internet access must request an exemption by calling (301) 286-5661 or (703) 281-1745 by Monday, May 1, 1998. For all other general STTR inquiries call (301) 918-1980.

6.2 Electronic Technical Proposal Preparation

By **technical proposal**, we mean the **part of the submission as described in section 3.4.**

Word Processor. NASA converts all electronic technical proposal files to PDF format for evaluation purposes. Therefore, NASA requests that technical proposals be submitted in PDF format, and encourages companies to do so. Other acceptable formats for PC are AmiPro, ClarisWorks for Windows, MS Works, Text, MS Word, WordPerfect, Postscript, and Adobe Acrobat. Other acceptable formats for Macintosh are ClarisWorks, MS Works, MacWrite Pro, Text, MS Word, WordPerfect, Postscript, and Adobe Acrobat. **If the file is self-extracting, then the offeror is limited to MS Word or WordPerfect formats.** Unix and TeX users please note, due to PDF difficulties with non-standard fonts, please output technical proposal file to DVI format.

Graphics. The offeror is encouraged for reasons of space conservation and simplicity, but not required, to embed graphics within the word processed document. For graphics submitted as separate files, the acceptable file formats (and their respective extensions) are: Bit-Mapped (.bmp), Graphics Interchange Format (.gif), JPEG (.jpg), PC Paintbrush (.pcx), WordPerfect Graphic (.wpg), and Tagged-Image Format (.tif).

Data Compression. Offerors are permitted to submit compressed data files using the Internet or Postal Submission. For PC based submissions, the Pkzip data compression application shall be used. For Macintosh-based submissions, the Stuffit data compression application shall be used.

Limitations. While only the paper copy will be screened for administrative compliance, the various files comprising the electronic version are required to exactly reflect the paper version.

Virus Check. The offeror is responsible for performing a virus check on each submitted technical proposal. As a standard part of entering the proposal into the processing system, NASA will scan each submitted electronic technical proposal for viruses. **The detection, by NASA, of a virus on any submitted electronic technical proposal, may cause rejection of the proposal.**

6.3 Internet Submission

An Electronic Handbook for submitting proposals via the World Wide Web is available on the NASA SBIR/STTR Home Page (<http://sbir.nasa.gov>). The handbook will electronically guide the submitting firm through the various steps for submitting STTR proposals, and issue secure user identification and passwords for each submission. The electronic handbook also includes: SBIR/STTR overview, schedules, previous awards history, sample proposals, other Federal SBIR/STTR Internet sites, and the 1998 STTR Solicitation. In addition, the electronic handbook supports secure electronic submission of Forms 9A, 9B and 9C, the technical proposal, award announcements, and debriefings. Communication between NASA and the firm will be via a combination of e-mail and electronic handbooks.

Important: After you have submitted Forms 9A, 9B, and 9C via the Internet, you may use the handbook for printing out the three forms on your own printer. These forms should be used as part of your Postal Submission.

6.4 Postal Submission

Postal Submissions are comprised of:

1. One original signed paper copy of the proposal, including paper copies of the signed Cooperative Agreement and all original forms (printed from 6.3 above)
2. Three additional paper copies of the entire proposal. Each proposal copy is to be stapled separately.
3. The electronic technical proposal as defined in Section 6.2 (if Internet submission is not utilized). Do not submit Forms 9A, 9B, and 9C on electronic media. These must be submitted via the web site.

6.4.1 Physical Packaging Requirements

Paper Copies of Proposal. Do not use bindings or special covers. Staple the pages of each copy of the proposal in the upper left-hand corner only. Secure packaging is mandatory. NASA cannot process proposals damaged in transit. All items for any proposal must be sent in the same envelope. If more than one proposal is being submitted, each proposal must be in its own envelope, but all proposals may be sent in the same package. Do not send duplicate packages of any proposal as "insurance" that at least one will be received.

Electronic Media for Technical Proposal. If electronic technical proposals are submitted in the Postal Submission, they must be submitted in duplicate (primary and backup) on acceptable electronic media. Acceptable electronic media include 3.5-inch diskettes, Iomega ZIP disks, or CD ROMs in either PC or Macintosh formats. Electronic media can be used to submit multiple electronic technical proposals for multiple submissions as long as (1) each submission is placed in a separate folder (or directory), and (2) the folder is named using the Internet Submission provided Proposal Submission ID. Electronic media shall be clearly labeled externally with the following information: Primary or Backup, Proposal Title and Number, Offeror Name, Computer Platform and Software used, Compression Program used (if any), and a listing of all files on the media.

6.4.2 Where to Send Proposals

All proposals that are mailed through the U.S. Postal Service first class, registered, or certified mail; proposals sent by express mail or commercial delivery services; or hand-carried proposals **must be** to be delivered to the following address between 8:00 a.m. and 5:00 p.m. EDT:

Allied Technology Group, Inc.
Mail Stop 120
4200 Forbes Blvd. Suite 106
Lanham, MD 20706-4342

The following telephone number may be used when required for reference by delivery services: (301) 918-1980. **Proposals cannot be received on Saturdays, Sundays, or Federal holidays.**

6.4.3 Deadline for Proposal Receipt

Deadline for receipt of Phase-I proposals is 5:00 p.m. EDT on Thursday, May 14, 1998. Any proposal received after that date and time will be considered late. Since the postmark (or other carrier's date mark) will be the evidence on which the decision is made, offerors must assure themselves that the postmark (or other carrier's date mark) is clear and easily legible; hand cancellation is suggested. Postage meter date stamps are not acceptable. **It is not sufficient for an electronically submitted proposal to be on time, the signed original paper version must be received at NASA by the date and time stated above.** Proposals may not be submitted by facsimile. Late proposals will not be eligible for award and will be rejected without review.

6.5 Acknowledgment of Proposal Receipt

NASA will acknowledge receipt of proposals by email to the address on the proposal cover sheet. If a proposal acknowledgment is not received within 30 days following the closing date of this Solicitation, the offeror should call (301) 918-1980. NASA will not respond to such inquiries made prior to June 14, 1998.

6.6 Withdrawal of Proposals

Proposals may be withdrawn by written notice, fax, or telegram (including Mailgram) received at any time before award. Proposals may also be withdrawn in person by an offeror or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the proposal.

7. Scientific and Technical Information Sources

7.1 NASA Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Homepage

Detailed information on NASA's SBIR and STTR Programs are available on the Internet at: <http://sbir.nasa.gov>.

7.2 NASA Commercial Technology Network

The NASA Commercial Technology Network (NCTN) contains a significant amount of on-line information about the NASA Commercial Technology Program. The address for the NCTN Home Page is: <http://nctn.hq.nasa.gov/>

7.3 United States Small Business Administration (SBA)

A copy of the Policy Directives for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs, which also state the SBA policy for this solicitation, may be obtained from the following source.

Office of Innovation, Research and Technology
U.S. Small Business Administration
409 Third Street, S.W.
Washington, D.C. 20416
(202) 205-7701

SBA information can also be obtained via Internet at the following address: <http://www.sbaonline.sba.gov/>.

7.4 Federal Research in Progress (FEDRIP) Database

One service available through this database is on-line access to abstracts of research from all agencies. FEDRIP is accessible through DIALOG, a private information service. For a free copy of the FEDRIP Search Guide, call (703) 487-4650 and ask for PR 847.

7.5 NASA Technology Utilization Services

The **National Technology Transfer Center (NTTC)**, sponsored by NASA in cooperation with other Federal agencies, serves as a national resource for technology transfer and commercialization. NTTC has a primary role to get Government research into the hands of U.S. businesses. Its gateway services make it easy to access databases and to contact experts in your area of research and development. For further information, call (800) 678-6882.

NASA's network of **Regional Technology Transfer Centers (RTTCs)**, listed below, provides a variety of business planning and development services to NASA STTR offerors. However, NASA does not accept responsibility for any services these centers may offer in the preparation of proposals. RTTCs should be contacted directly to determine what services are available and to discuss fees charged since these vary, depending upon the organization and type of service requested. To contact any RTTC, call toll-free (800) 472-6785.

Northeast:

Center for Technology Commercialization
Massachusetts Technology Park
1400 Computer Drive
Westborough, MA 01581

Mid-Atlantic:

Mid-Atlantic Technology Applications Center
University of Pittsburgh
3400 Forbes Avenue, 5th Floor
Pittsburgh, PA 15260

Southeast:

Southern Technology Applications Center
University of Florida, College of Engineering
One Progress Boulevard, Box 24
Alachua, FL 32615

Mid-West:

Great Lakes Industrial Technology Center
Battelle Memorial Institute
25000 Great Northern Corporate Center, Suite 450
Cleveland, Ohio 44070-5310

Mid-Continent:

Mid-Continent Technology Transfer Center
Texas Engineering Extension Service
Technology & Economic Development Division
College Station, TX 77843-8000

Far-West:

Far-West Regional Technology Transfer Center
University of Southern California
3716 South Hope Street, Suite 200
Los Angeles, CA 90007-4344

7.6 National Technical Information Services

The **National Technical Information Service**, an agency of the Department of Commerce, is the Federal government's central clearinghouse for publicly funded scientific and technical information. For information about their various services and fees, call or write:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Tel: (703) 487-4600
Fax: (703) 321-8647

8. Research Topics

INTRODUCTION: Centers of Excellence

To reduce overlap and streamline administrative and programmatic functions, NASA's senior management has established areas of excellence and specific missions for each of the NASA field installations. These are termed Centers of Excellence (CE). Each CE represents a focused, Agency-wide leadership responsibility in a specific area of technology or knowledge. CE's are chartered with a clear definition of their capabilities and boundaries. They are charged to be preeminent within the Agency, if not worldwide, with respect to the human resources, facilities, and other critical capabilities associated with the particular area of excellence. Each CE must maintain or increase the Agency's preeminent position in the assigned area in line with the program requirements of the Strategic Enterprises and the long-term interests of the Agency. More information can be found in the 1998 NASA Strategic Plan (<http://www.hq.nasa.gov/office/nsp/framework.htm>).

Beginning with this Solicitation, the NASA STTR Program will be aligned with the CE's. Within this alignment, each CE may submit a topic. The topics will be focused on one or two product areas or challenges faced by the CE, with the focus expected to change each year depending on the CE's needs. This year, seven CE's are participating.

Topic 1 Scientific Research

NASA Installation: Goddard Space Flight Center

Goddard Space Flight Center is designated the Center of Excellence for Scientific Research and has been assigned the Agency-wide leadership responsibility in conducting research in space and Earth sciences.

The mission of the Space Science Program is to solve mysteries of the universe, explore the solar system, discover planets around other stars, search for life beyond Earth; from origins to destiny, chart the evolution of the universe and understand its galaxies, stars, planets, and life. Space Science Program seeks to understand the universe from the beginning of time, looking ever deeper with increasingly capable telescopes to scan the entire electromagnetic spectrum from gamma rays to radio wavelengths. It also uses probes sent into interstellar space.

The mission of the Earth Science Program is to study the Earth and its environment by monitoring incoming solar radiation and observing the atmosphere, oceans, land and biota, and cryosphere to determine their influence on weather, climate and geodynamics. Earth Science uses the unique vantage point of space to enable dynamic monitoring of the global Earth system in particular to record and understand natural changes and distinguish these from those induced by human activities. In addition, Earth Science Program uses in-situ and airborne measurement systems to verify and complement data acquired from Earth orbiting satellites.

Core technology challenges to support this Center of Excellence for this Solicitation include:

Sensors and Detectors

Advancement in materials, designs, and processes to improve functional performance, increase viable bandwidths, and reduce volume, mass, and power of scientific instruments are sought to enable the space and Earth science missions of the future.

- Low power (< 2 Watts), low mass (< 2 kg) neutral and ionized particle analyzers.
- Low power, low noise detectors covering the UV to IR wavelength spectrum from 0.2 microns to 30 microns designed and packaged consistent with instrument systems that have a total mass of 25 kg and dissipate 20 Watts.
- Detector systems for analyzing photon and cosmic ray emanations from astrophysical phenomena:
 - * Gamma-ray detectors with greater spatial resolution; 100 microns for 10 to 100 keV cosmic rays, 1 mm for 100 keV to 10 MeV cosmic rays; and spectral resolution; 3% for 10-50 keV, 1% for 50-200 keV, and 0.1%

for 200 keV to 1 MeV. Large arrays of detectors (1000 to 10000 cm² effective areas) and room temperature operations are highly desirable.

X-ray detectors for future cryogenic imaging spectrometers will require focal plane arrays measuring photon energies to at least better than 10 eV (FWHM), with a goal of < 2 eV. Detectors should have provisions for reading out arrays of at least 30 x 30 pixels, in a manner consistent with small, long-lived cryogenics (< 200 micro-watts of power to the coldest cryogenic stages without large loads at higher temperature stages). Improved CCDs should have larger formats (> 1 k x 1 k and also long rectangular arrays for grating read-out), high resistance to radiation damage, and their sensitivity extended to higher (> 10 keV) and lower (~ 0.1 keV) energies (not necessarily simultaneously in the same device).

- * UV/optical detectors: photon counting detectors with 4 k x 1 k pixels or larger formats or equivalent spectroscopic formats, 10 micron or smaller pixels, higher maximum count rate limits, direct-deposit photocathodes, and quantum efficiencies > 20%. Improved microchannel plates (smaller pores, larger area, lower feedback, and higher production yield). More radiation tolerant detector systems.
 - * near-IR detectors with 1k x 1k pixels or larger formats with at least a factor of two lower read noise and lower dark noise.
 - * large format far-IR detector arrays with sensitivity limited by the cosmic infrared background radiation.
- Silicon avalanche photodiode detector arrays: 10 to 100 elements in linear and/or area arrays at 1000 nm wavelength with > 60% quantum efficiency.

Lasers and Light Collectors

Improvements are needed for lasers and reflective and refractive optics for space science and Earth science studies. Innovations are required in the overall efficiency, compactness, and reliability of lasers and light collectors with the goal of developing a new generation of instrumentation for better, cheaper and faster flight missions.

- Miniature instruments for short range and large instruments for global surveys:
 - * laser wavelengths of interest:
 - ranging/Doppler: all Nd hosts (e.g., 266 nm, 355 nm, 532 nm, 1064 nm).
 - spectroscopy: water (825 nm, 935 nm); ozone (280 nm to 320 nm); others for specific species.
 - diode based lidar: any available wavelengths.
 - * miniature instruments: 0.1 microJ to 10 microJ/pulse laser energy; 1 microsecond to 10 microsecond wavelength stability; 1 ms to 10 ms pulse widths; 1 kHz to 5 kHz pulse repetition rates; > 20% wallplug efficiency.
 - * large instruments: 0.1 J to 1 J/pulse laser energy; 1 pm to 100 pm wavelength stability; 3 ns to 50 ns pulse widths; 40 Hz to 100 Hz pulse repetition rates; > 5% wallplug efficiency.
- Surface lidar sensor system:
 - * laser wavelengths of interest: 700 nm to 2000 nm.
 - * laser pulse energy: 1 mJ to 10 mJ/pulse, pulse width: 10 ns; pulse repetition rates: 1 k to 10 k; overall efficiency: > 10%.
 - * graphite composite telescope mirror: ~ 2 m diameter, < 20 kg, < 50 microradian image blur.
 - * 50 mm diameter scan mirror assemblies with 2 arc sec accuracy.
- Wind lidar sensing system:
 - * laser wavelengths of interest: clouds (355 nm, 532 nm); water vapor (940 nm, 1064 nm); O₂ A Band (760 nm to 770 nm, 1500 nm).
 - * laser pulse energy: ~ 1 J/pulse at 10/20 Hz, ~ 200 mJ/pulse at 500 Hz; spectral width range: 20 MHz at 1500 nm, 150 MHz at 355 nm; stability: 20/30 MHz short term; efficiency: 5% to 15%; lifetime in space: 3 yrs. to 5 yrs.
 - * deployable scanning telescopes: 1 m² to 2.5 m² aperture with weight < 50 kg.
- Active and deployable optics including wavefront sensing methods:
 - * < 0.1 sec execution time.
 - * better than 0.001 wave rms accuracy and 0.01 wave rms precision.

- * deterministic time methods, as opposed to iterative.
 - * comparative analysis between conventional sensing techniques.
 - * optimal control law to map wavefront error to actuator motions.
 - * Cryogenic actuators for active optics.
 - * Cryogenic deformable mirrors.
 - * Wavefront sensing with a large dynamic range for slowly moving systems.
- Compact, single-frequency, continuous-wave laser systems tunable at visible wavelengths (589 nm, 589.6 nm, 557.7 nm, and 630.5 nm) that are stabilized to 1 part per billion for periods up to 10 hours.
 - UV (90-240 nm) diffraction gratings with high efficiency and low scatter.
 - UV filters with effective wavelengths between 90 nm and 240 nm with peak throughputs better than 70% and sharp band edges, 10^6 out-of-band rejection.
 - Tunable optical filters for use in cryogenic systems.
 - Lightweight, large-aperture sub-mm to X-ray optics, including:
 - * UV/Optical optics or optical systems with 2 m (or larger) diameters with a mass of $< 5 \text{ kg/m}^2$ and a surface figure good to $\lambda/8$ at 100 nm with a improved microroughness. Cost to manufacture less than \$1 M/m².
 - * Large aperture space telescope optics. Including: Large (many meters) far-IR ultralight cryogenic (few Kelvin) telescopes with surface accuracy of a few microns with associated deployment technology.

Topic 2 Human Operations in Space

NASA Installation: Johnson Space Center

The Center of Excellence for Human Operations in Space seeks to expand the human experience into the far reaches of space through exploring, using, and enabling the development of space. Human presence in space requires research and technology for the adaptation to the space environment. In exploring space, the knowledge gained will also provide fundamental insights for new earthbound applications and technology.

Core technology challenges to support this Center of Excellence for this Solicitation include:

Life support waste water recovery systems

Three critical regenerative life support areas present challenges to develop safe, reliable physicochemical and/or biological processes that have low weight, and power consumption and require minimal expendables.

- **Solid waste resource recovery:** Processes that produce usable constituents without producing toxic byproducts. Useable constituents include gaseous carbon dioxide and nitrogen and solid inorganics that can be used in hydroponics nutrient solutions. Unusable waste byproducts should be chemically and biologically stable and require significantly less storage volume than the solid waste volume.
- **Waste water recovery:** Processes that produce potable water by reducing waste water impurities from greater than 500 PPM total organic carbon (TOC) to less than 0.25 PPM TOC and inorganic salts from greater than 1000 PPM dissolved solid to less than 50 PPM. The use of biological processes will require the reduction of ammonium ion from greater than 500 PPM to less than 0.25 PPM.
- **Plant crop lighting:** Light sources that have higher electrical conversion and photosynthetic spectral efficiencies through improved lamp design. New ways to deliver light (from electrical or solar sources) directly or indirectly with light transmitting structures, high efficiency solar collectors, and optical distribution. Lighting technology that will significantly reduce the amount of waste thermal energy is necessary for application of plant systems to space. Proposals in all three critical areas should include specialized instrumentation required for process monitor and control.

In-situ resource utilization

In-situ resource utilization development of processes which extract or otherwise use indigenous surface or atmospheric materials from the Moon and Mars as a source for the following: propellants, oxygen, water and other life support

consumables, radiation protection, and construction materials. Utilization systems that extract raw materials, process the raw materials into useful products, and store the products for later use.

Potential In-Situ Propellants include:

Lunar			Mars		
Propellant	Resource	Earth Consumable	Propellant	Resource	Earth Consumable
O ₂ & Al	Regolith	Recycled	CO ₂ , O ₂ or O ₂ & CO	Atm. (CO ₂)	None or Recycled
SiH ₄ & O ₂	Regolith	H ₂	O ₂ & CH ₄	Atm. (CO ₂)	H ₂
O ₂ & H ₂	Water	None	O ₂ & CH ₃ OH	Atm. (CO ₂)	H ₂
CH ₄ & O ₂	Water	Carbon	O ₂ & H ₂	Water	None
H ₂ & O ₂	Solar wind deposited in Regolith	None	O ₂ & CH ₄	CO ₂ & Water	None
			O ₂ & CH ₃ OH	CO ₂ & Water	None
CH ₃ CH ₂ OH	Plants Grown		CH ₃ CH ₂ OH	Plants Grown	

Current studies of future Mars exploration mission envision the in situ resource utilization propellant production system challenges are to provide the following production rates to support the transportation ascent systems: For robotic activities, 1 to 2 metric tons. For Human missions, 30 to 40 metric tons. Propellant production needs are based on Mars ascent and trans-Earth injection energy and oxygen/hydrocarbon propulsion system performance.

Topic 3 Launch and Payload Processing Systems

NASA Installation: Kennedy Space Center

The Center of Excellence for Launch and Payload Processing Systems is continually advancing the state of the art in launch and payload processing hardware, software, and support activities. Development of innovative technologies needed to improve operational safety and reliability, reduce costs and shorten flight hardware processing turnaround times is critical to NASA's continued excellence in launch and payload processing. NASA's goals to achieve affordable access to space require greater efficiencies in ground operations for current and future space flight vehicles and payloads. The four primary goals of the Center of Excellence are to 1) assure that sound, safe, and efficient practices and processes are in place for privatized/commercialized launchsite operations; 2) increase the use of KSC's operations expertise to contribute to the design and development of new payloads and launch vehicles; 3) utilize KSC's operations expertise in partnership with other entities (government, industry, academia) to develop new technologies for future space initiatives; and 4) continually enhance core capabilities (people, facilities, equipment, and systems) to meet agency objectives and customer needs for faster, better, and cheaper development and operations of space systems.

Core technology challenges to support this Center of Excellence for this Solicitation include:

Remote Sensing of Electric Fields or Charges Aloft

Aerospace vehicles in flight, especially during the launch phase, are extremely vulnerable to natural and triggered lightning. Currently the threat of lightning can only be inferred from the presence of actual lightning, high surface electric fields, or disturbed weather conditions. Airborne measurements of electric fields aloft are technically possible but prohibitively expensive. A cost-effective method for remotely measuring electric fields or charge aloft from the ground is required. NASA requires a prototype system meeting operational specifications. An operational system must measure the magnitude of either the charge or the electric field in and around precipitating and non precipitating clouds at altitudes from near the surface to above 50,000 feet above ground level. The system must provide the data in near real-time with a data latency of 5 minutes or less and an error less than +100%/-50%.

Active Power Factor Correction Technology

Electrical power quality is becoming increasingly critical to NASA. The most significant threat to power quality comes from the nonlinear power supplies used in virtually all data processing hardware at the Kennedy Space Center. High harmonic distortion causes erratic equipment operation, and in some cases results in fire and/or electrical shock hazards. Innovative solutions are needed which target declining power quality in the space shuttle's main processing centers and thereby improve system performance. A fundamental issue is the fact that as current harmonics increase the RMS value of the current waveform, they do not deliver any real energy in watts to the load. The result is that, in new systems, designs must account for higher harmonic distortion levels by the use of larger distribution hardware (K-factor rated transformers, larger conductors, larger breakers etc.). The switched mode power supply designs used today in PCs and most rack mounted equipment is of a 1970s vintage and is a major producer of input current harmonic distortion. Current power supply designs realize a power factor of approximately 70% as a result of high harmonic distortion. The traditional approach for problem mitigation involves filtering or electrical isolation. Technology now exists that would correct this distortion problem at its source rather than cleaning or containing it after its generation. This initiative would develop a power converter circuit topology to mitigate injected distortion by synthesizing a purely sinusoidal input current. The use of an advanced power converter eliminates the additional stresses on the power distribution

loads and will therefore save on overall project costs. Further, in existing power distribution systems, this technology can significantly reduce the load on the electrical system. This initiative should develop a power converter circuit topology to mitigate injected distortion by synthesizing a purely sinusoidal input current. The intent is to prototype a converter with low input distortion, higher efficiency, and higher reliability than the power supplies commonly available today. Development of such circuits, at a higher power capacity, could significantly improve power quality at KSC's data processing centers.. The new prototype circuit should realize power factors near 100%, a significant improvement. The design should be of suitable physical size and power capacity to replace standard PC and/or rack-mounted power supplies commonly available.

Topic 4 Structures and Materials

NASA Installation: Langley Research Center

The Center of Excellence for Materials and Structures targets innovative tools and advanced technologies which can lead to lower operating and manufacturing costs, increased flight safety, reduced structural weight, and advanced structural concepts and materials. These are critical to lowering the acquisition costs of new and derivative spacecraft and space platforms as well as subsonic and supersonic commercial transport aircraft. Advanced materials and structures are necessary to extend the mission life, increase launch payload, increase orbital trajectory capabilities, and lower the acquisition costs of commercial launch vehicles and proposed single stage to orbit launch vehicles.

Core technology challenges to support this Center of Excellence for this Solicitation include:

Resin Development

State-of-the-art (SOTA) resin systems are based on epoxide polymer chemistry. Epoxies resin systems, as common as they are, lack in several key physical areas such as; maximum service temperature, fracture toughness, etc. New resin systems are needed to meet the requirements demanded by future advanced spacecraft and aircraft transports. Advanced resin systems will have to surpass the limitations of current resin technology. Not only will the material properties have to far exceed those of SOTA polymers but they will have to be able to be radiation cured, resin transfer molded, used in rapid prototyping, and adaptable to smart materials applications. Specific opportunities include:

- **Radiation Curing:** New resin systems which are curable by electron beam, UV radiation, etc.; fabrication methods which utilize radiation curable resin systems; and composite structures which will maximize the abilities of non-autoclavable resin systems.
- **Resin Transfer Molding:** New high temperature or radiation curable resin systems which will increase the physical properties of the structure over present systems; improved RTM equipment capable of fabricating structures which are composed of high temperature or radiation curable resin systems; new fabrication methods; and new structural concepts.

- **Rapid Prototyping:** Modifications to existing Laminated Object Manufacturing Technology (LOM) to allow the rapid manufacture of complex composite structures, while utilizing radiation curable resin systems; and modification to stereolithography equipment to allow for increased structural integrity of fabricated parts by utilizing new resin systems or particle inclusions.
- **Smart Materials:** Development of improved sensors and actuator systems and methods to produce these at a reasonable cost; develop new resin systems which exhibit improved piezoelectric response over current technology; develop new methods for fabricating smart materials at a low cost; and develop new structural applications for smart materials. The development of new polymers that can be used in the fabrication of micro electromechanical systems (MEMS) is important.

Multifunctional Structures

The integration of multiple functions to accomplish reduced subsystem cost and weight while maintaining or improving system performance by making the structure multifunctional for spacecraft and aircraft are needed. Also needed are structural concepts which integrate smart materials, superconductors, and electronics at cryogenic and room temperature. Specific opportunities include:

- **Passive Damping:** Damping concepts that are integral with the structural concepts for maintaining the stability of spacecraft with stringent pointing and jitter requirements. Effective means of providing passive or material damping at cryogenic temperatures (20 - 70 K) for the stability of future planned large space telescopes.
- **Position Control Actuators:** Highly accurate (5 nanometer) position holding actuators capable of operation at cryogenic temperatures for maintaining the shape of primary mirrors of planned space telescopes. These actuators must hold position when the power is off to eliminate heat dissipation and power consumption.
- **Membrane Reflectors with Integral Actuation:** Since the trend in reflective surfaces for ultra-lightweight telescopes is toward thinner reflectors (e.g. membranes), integral support structure and membrane actuation concepts including non-contacting actuators are desired for applications to infrared and optical telescopes.

Topic 5 Turbomachinery

NASA Installation: Lewis Research Center

In the Center of Excellence context, turbomachinery refers to *turbine driven* systems for propulsion, power generation, and energy conversion. These systems include rotating and related components, and associated enabling technologies. Turbomachinery technology is central to propulsion, power, and energy conversion systems for aeronautics, space, and terrestrial applications. The components and technologies associated with the Turbomachinery are broad in scope. For rotating components, it includes fans, compressors, turbines and pumps. Related components are inlets, ducts, combustors, mixers, nozzles, nacelles, actuators, sensors, bearings, gears and seals. The associated enabling technologies are acoustics, combustion, cryogenics, icing, dynamics, tribology, mechanical systems, controls, heat transfer, instrumentation, materials and structures, simulation systems/models, fluid mechanics, turbulence and transition.

A core technology challenge to support this Center of Excellence for this Solicitation includes:

Microfabricated Devices

The development of microfabricated sensors, actuators, and control technologies will be critical to improved monitoring of spacecraft propulsion systems, as well as subsonic, and supersonic aircraft. Furthermore, advanced micro sensor systems are necessary to extend the mission life, reliability, performance, safety, efficiency, affordability, and environmental capability.

Opportunities include the development of sensors, actuators, and control technologies integrated into micro systems for measurements within propulsion system components. This includes the development of sensor systems for high vibration rotating elements subjected to high temperatures, high shear stresses, and corrosive media in order to

improve health monitoring and duty cycle maintenance. This activity aims at the implementation of Micro Electro Mechanical Systems (MEMS) technology to turbine engine sensing and controlling. The focus is on the demonstration of the technology in an engineering fashion to propulsion systems.

Topic 6 Space Propulsion

NASA Installation: Marshall Space Flight Center

The Center of Excellence seeks development of affordable, high-performance launch and space transportation capabilities. Key to this goal is the application of innovative, non-traditional propulsion technologies, devices and systems that could contribute to dramatic reductions in launch costs and in-space transportation time. Development of such technologies is sought to enable ambitious commercial, robotic and human exploration missions in the future.

A core technology challenge to support this Center of Excellence for this Solicitation includes:

Exotic "Breakthrough" Technologies

Results from "leading edge" physics and engineering research at research institutions can lead to exotic "breakthrough" technologies. The following are some specific areas that will provide significant advancements in space transportation capability and lead to development of affordable, high-performance propulsion technologies:

- Research which could lead to techniques for manipulation of relativistic phenomena, exploitation of vacuum zero-point fields and/or hyper-fast transportation.
- Research and technology advancement in antimatter production, storage, transportation, and utilization for application as a propulsion energy source. Of special interest is research which could lead to methods for convenient, low-cost antiproton production and robust, high-containment density storage devices.
- Propulsion applications of technology innovations in fission or fusion energy production. Of special interest is research leading to application in commercial transportation and energy markets, and methods for economical and environmentally acceptable testing.
- Enhancements to or development of new propulsion systems utilizing electromagnetic fields or solar interactions, such as solar/magnetic sails, solar thermal propulsion and electrodynamic tethers.
- Technology innovations for beamed power primarily in the area of launch applications. Of special interest is research leading to economical launch of small payloads and affordable electromagnetic transfer of power from space to Earth.

Topic 7 Rocket Propulsion Test

NASA Installation: Stennis Space Center

The Center of Excellence will be conducting test programs for the propulsion systems of the next generation of launch vehicles. These programs will test systems using a range of liquid propellants from hydrocarbon fuel to cryogenic LOX/Hydrogen. The goal is to conduct the different test programs quickly, efficiently, and cost effectively. To do this, it will be necessary to develop new technologies that will assist in reducing the overall propulsion test operations costs (recurring costs) while improving the efficiency and safety of the test operations. These technologies should increase the reliability and performance of propulsion ground test facilities and operations methodologies.

Core technology challenges to support this Center of Excellence for this Solicitation include:

Spectroscopy Technology

Improvements to the safety and reliability of propulsion system testing can be made with spectroscopy technology. Only a relatively small portion of the electromagnetic spectrum has been investigated for use in propulsion system testing and exhaust plume diagnostics/vehicle health management. Of special interest is the detection and characterization of metallic specie emissions in hydrocarbon fueled rocket engines using emission and absorption spectroscopy. The hydrocarbon technology would be of interest for emission control. The initial developments should be focused on RP-1 fuel and metallic specie emissions in the 0.3 to 1.5 micron range.

Thrust Measurement Systems

Propulsion test operations can be improved with advanced thrust measurement systems. The new thrust measurement systems for rocket engine testing need to offer greater flexibility and adaptability to changing test requirements. The current technology requires 18 months or more to design and fabricate thrust measurement systems. Requirements for thrust measurement systems include: 1/2% accuracy or better, ability to measure side loads during engine gimbling, and the ease of manufacture, installation and calibration. Three ranges of thrust measurement will be required for future programs: 20,000 to 100,000 pounds, 100,000 to 1,000,000 pounds, and 1,000,000 to 2,000,000 pounds. First required thrust measurement system will be for an axi-symmetric engine with thrust capability of 600,000 to 1,000,000 pounds.

Appendices (Submission Forms and Certifications)

Appendix A Form 9A - Proposal Cover Sheet (to be submitted via Internet)

Appendix B Form 9B - Project Summary (to be submitted via Internet)

Appendix C Form 9C - Summary Budget (to be submitted via Internet)

Appendix D Model Cooperative Agreement Letter

Appendix E Model Allocation of Rights Agreement

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Form 9A - PROPOSAL COVER SHEET

1998 NASA STTR Phase-I Proposal

1. NASA Research Topic:

2. Project Title:

3. Small Business Concern (SBC):
Name:

Research Institution (RI):
Name:

Address:

Address:

Telephone No:

Facsimile No:

Electronic Mail ID:

4. Phase-I: Amount Requested:

Duration:

months

5. Certifications: The above SBC certifies that, as defined in Section 2 of the Solicitation, it qualifies as:

- | | | | |
|--|-----|----|----------------------|
| • A SBC. | Yes | No | Number of Employees: |
| • A socially and economically disadvantaged SBC. | Yes | No | |
| • A woman-owned SBC. | Yes | No | |

The SBC and/or RI has submitted proposals containing a significant amount of essentially equivalent work under other federal program solicitations, or has received other federal awards containing a significant amount of essentially equivalent work. (If yes, identify proposals and/or contracts in Part 10 of the proposal).

Yes No

The above SBC certifies that a satisfactory Cooperative Agreement has been signed by the SBC and its RI.

Yes No

The SBC will perform ____% of the work (Refer to Section 1.1) and the RI will perform ____% of the work of this project.

7. Endorsements:

SBC Official:
Name:

PI/PM:
Name:

Title:

Employer:

Phone:

Signature:

Signature:

Date:

Date:

NOTICE: For any purpose other than to evaluate the proposal, this data shall not be disclosed outside the government and shall not be duplicated, used, or disclosed in whole or in part, provided that, if a funding agreement is awarded to this proposer as a result of or in connection with the submission of these data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the funding agreement. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction are contained in pages ____ of this proposal.

Guidelines for Completing Proposal Cover Sheet

1998 NASA STTR Phase-I Proposal

General: Complete Form 9.A electronically by following the instructions on the proposal electronic media. Print one copy of Form 9A and sign it manually. This will be the signed cover sheet for the paper copy of the proposal to be submitted to NASA along with the competed proposal electronic media. (Sections 3.2, 3.3, 3.4 and 6.1 for further instructions.)

1. Research Topic: Enter NASA research topic number and title (Section 1.5).
2. Project Title: Enter a brief, descriptive title, avoid words like "development" and "study" and do not use acronyms or trade names.
3. Small Business Concern: Enter the full name and address of the company submitting the proposal. If a joint venture, list the company chosen to negotiate and receive contracts. If the name exceeds 40 keystrokes, please abbreviate.

Research Institution: Enter the full name and address of the research institute.

Address: Enter address where mail is received.

State: Enter 2-letter designation (example Maine: ME)

Zip Code: Enter 5- or 9-digit code

Telephone: Enter phone number of the SBC and RI including area code.

Facsimile: Same as telephone.

E-mail ID: Enter Internet address of primary SBC and RI contact.

4. Phase-I - Amount Requested: Enter proposal amount from Budget Summary. The amount requested should not exceed \$100,000; round to nearest dollar. Do not enter cents.

Duration: Enter the proposed duration in months. If the proposed duration is other than 12 months, be sure to discuss the reason in the text of the proposal.

5. Certifications: Indicate Yes or No by placing an "X" after the appropriate answer. The Cooperative Agreement shall be in compliance with the solicitation.
6. Provide percentage distributions of the work (amount requested including cost sharing, less fee, if any)
7. Endorsements: The proposal should be signed by an official of the firm qualified to make a contractual commitment on behalf of the firm and by the proposed Principal Investigator/Project Manager.

The cover sheet submitted to NASA in hard copy should have original signatures.

Form 9B - PROJECT SUMMARY

1998 NASA STTR Phase-I Proposal

1. Topic No. and Title:

2. Project Title:

3. Small Business Concern
Name and Address:

4. Principal Investigator/
Project Manager:

5. Research Institution
Name and Address:

6. Technical Abstract (Limit 200 Words):

7. Potential Commercial Application(s):

Guidelines for Completing Project Summary

1998 NASA STTR Phase-I Proposal

Complete Form 9B electronically and print copy for second page of the proposal.

1.Topic No. and Title: Enter research topic number and title chosen by offeror

2.Project Title: Enter the same project title as shown on your proposal Cover Sheet.

3.Firm name and address: Enter as shown on the Proposal Cover sheet.

4.Principal Investigator/Project Manager: Enter name as shown on the Proposal Cover sheet.

5.Research institution name and address: Enter as shown on the Proposal Cover sheet.

6.Technical Abstract: Provide a summary of 200 words or less of your proposed project. The abstract must not contain proprietary information and must describe the NASA need addressed by the proposed cooperative R/R&D effort.

7.Potential Commercial Application(s): Summarize the direct or indirect commercial potential of the project, assuming the goals of the proposed R/R&D are achieved.

Form 9C - SUMMARY BUDGET

1998 NASA STTR Phase-I Proposal

1. Small Business Concern:

2. Project Manager:

3. DIRECT LABOR:

Category	Hours	Rate	Cost
----------	-------	------	------

(a) TOTAL DIRECT LABOR:\$

4. OVERHEAD RATE:

___% of Total Direct Labor

(b) OVERHEAD COST: \$

5. OTHER DIRECT COSTS (ODC)

Category	Cost \$
----------	---------

(c) TOTAL ODC: \$

6. $\langle (a)+(b)+(c)=(d) \rangle$

(d) SUBTOTAL: \$

7. G&A RATE ___% of Subtotal

(e) G&A COSTS: \$

8. $\langle (d)+(e)=(f) \rangle$

(f) TOTAL COSTS: \$

9. Add FEE or Subtract COST SHARING (as applicable)

(g) FEE/SHARING: \$

10. $\langle (f)+(g)=(h) \rangle$

(h) AMOUNT REQUESTED: \$

THIS PROPOSAL IS SUBMITTED IN RESPONSE TO 1998 NASA STTR PROGRAM SOLICITATION AND REFLECTS OUR BEST ESTIMATES AS OF THIS DATE:

11. TYPED NAME AND TITLE:

12. SIGNATURE:_____

13. DATE:_____

Guidelines For Preparing Summary Budget Form

1998 NASA STTR Phase-I Proposal

By using this form, the offeror submits to the Government a pricing proposal of estimated costs with detailed information for each cost element, consistent with the offeror's cost accounting system. (Section 3.6 for further information.) Prepare electronically and print and sign a paper copy for submission to NASA with the proposal.

This summary does not eliminate the need to fully document and justify the amounts requested in each category. Such documentation should be contained, as appropriate, on a budget explanation page immediately following the budget in the proposal. (See below for discussion on various categories)

1. Small Business Concern - Enter name of Small Business Concern in the same form as on page 1, the proposal cover sheet.
2. Project Manager - Enter the Small Business Concern's Project Manager.
3. Direct Labor - Enter labor categories (e.g., principal investigator/project manager, laboratory assistant, administrative staff), rates of pay and the hours for each labor category.
4. Overhead - Specify current rate(s) and base(s). Use current rate(s) negotiated with the cognizant federal negotiating agency, if available. If no rate(s) has(have) been negotiated, a reasonable indirect cost (overhead) rate(s) may be requested for Phase-I that will be subject to approval by NASA. If a current negotiated rate(s) is(are) not available for Phase-II, NASA will negotiate an approved rate(s) with the offeror. The offeror may use whatever number and types of overhead rates that are in accordance with the firm's accounting system and approved by the cognizant federal negotiating agency, if available. Multiply Direct Labor Cost by the Overhead Rate to determine the Overhead Cost.
5. Other Direct Costs (ODC). (Include budget for the Research Institution as a Direct Cost).
 - Materials and Supplies: Indicate types required and estimate costs.
 - Documentation Costs or Page Charges: Estimate cost of preparing and publishing project results.
 - Subcontracts: Include a completed budget—including hours and rates and justify details. (Section 3.4, Part 10.)
 - Consultant Services: Indicate name, daily compensation, and estimated days of service.
 - Computer Services: Computer equipment leasing is included here.
 - Equipment: List each item of permanent equipment to be purchased, its price, and explain its relation to the project.

List all other direct costs that are not otherwise included in the categories described above.

6. Subtotal - Sum of (1) Total Direct Labor, (2) Overhead and (3) ODC.
7. General and Administrative (G&A)--Specify current rate and base. Use current rate negotiated with the cognizant federal negotiating agency, if available. If no rate has been negotiated, a reasonable indirect cost (overhead) rate may be requested for Phase-I that will be subject to approval by NASA. If a current negotiated rate is not available for Phase-II, NASA will negotiate an approved rate with the offeror. Multiply (4) Total Direct Cost by the G&A Rate to determine G&A Cost.
8. Total Costs - Sum of Items 6 and 7. Note that this value will be used in verifying the minimum required work percentage for the SBC and RI.
9. Fee/Cost Sharing - See Sections 1.1, 5.8 and 5.9. Fee to be added to total budget, shared costs to be subtracted from total budget, as applicable.

10. Amount Requested - Sum of Items 8 and 9, not to exceed \$100,000.

11/12. Name/Signature and Title of SBC Contracting Official.

MODEL COOPERATIVE AGREEMENT

By virtue of the signatures of our authorized representatives, _____ (Small Business Concern), _____ and _____ (Research Institution) _____ have agreed to cooperate on the _____ (Proposal Title) _____ Project, in accordance with the proposal being submitted with this agreement.

This agreement shall be binding until the completion of all Phase-I activities, at a minimum. If the _____ (Proposal Title) _____ Project is selected to continue into Phase-II, the agreement may also be binding in Phase-II activities that are funded by NASA, then this agreement shall be binding until those activities are completed. The agreement may also be binding in Phase-III activities that are funded by NASA.

After notification of Phase-I selection and prior to contract release, we shall prepare and submit, if requested by NASA, an **Allocation of Rights Agreement**, which shall state our rights to the intellectual property and technology to be developed and commercialized by the _____ (Proposal Title) _____ Project. We understand that our contract cannot be approved and project activities may not commence until the **Allocation of Rights Agreement** has been signed and certified to NASA.

Please direct all questions and comments to _____ (Small Business Concern representative) at _____ (Phone Number) _____.

signature

name/title

Small Business Concern

signature

name/title

Research Institution

**SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM
MODEL ALLOCATION OF RIGHTS AGREEMENT**

This Agreement between _____, a small business concern organized as a _____ under the laws of _____ and having a principal place of business at _____, ("SBC") and _____, a research institution having a principal place of business at _____, ("RI") is entered into for the purpose of allocating between the parties certain rights relating to an STTR project to be carried out by SBC and RI (hereinafter referred to as the "PARTIES") under an STTR funding agreement that may be awarded by _NASA_____ to SBC to fund a proposal entitled "_____ " submitted, or to be submitted, to by SBC on or about _____, 199__.

1. Applicability of this Agreement.

(a) This Agreement shall be applicable only to matters relating to the STTR project referred to in the preamble above.

(b) If a funding agreement for STTR project is awarded to SBC based upon the STTR proposal referred to in the preamble above, SBC will promptly provide a copy of such funding agreement to RI, and SBC will make a sub-award to RI in accordance with the funding agreement, the proposal, and this Agreement. If the terms of such funding agreement appear to be inconsistent with the provisions of this Agreement, the Parties will attempt in good faith to resolve any such inconsistencies.

However, if such resolution is not achieved within a reasonable period, SBC shall not be obligated to award nor RI to accept the sub-award. If a sub-award is made by SBC and accepted by RI, this Agreement shall not be applicable to contradict the terms of such sub-award or of the funding agreement awarded by NASA to SBC except on the grounds of fraud, misrepresentation, or mistake, but shall be considered to resolve ambiguities in the terms of the sub-award.

(c) The provisions of this Agreement shall apply to any and all consultants, subcontractors, independent contractors, or other individuals employed by SBC or RI for the purposes of this STTR project.

2. Background Intellectual Property.

(a) "Background Intellectual Property" means property and the legal right therein of either or both parties developed before or independent of this Agreement including inventions, patent applications, patents, copyrights, trademarks, mask works, trade secrets and any information embodying proprietary data such as technical data and computer software.

(b) This Agreement shall not be construed as implying that either party hereto shall have the right to use Background Intellectual Property of the other in connection with this STTR project except as otherwise provided hereunder.

(1) The following Background Intellectual Property of SBC may be used nonexclusively and, except as noted, without compensation by RI in connection with research or development activities for this STTR project (if "none" so state): _____;

(2) The following Background Intellectual Property of RI may be used nonexclusively and, except as noted, without compensation by SBC in connection with research or development activities for this STTR project (if "none" so state): _____;

(3) The following Background Intellectual Property of RI may be used by SBC nonexclusively in connection with commercialization of the results of this STTR project, to the extent that such use is reasonably necessary for practical, efficient and competitive commercialization of such results but not for commercialization independent of the commercialization of such results, subject to any rights of the Government therein and upon the condition that SBC pay to RI, in addition to any other royalty including any royalty specified in the following list, a royalty of _____% of net sales or leases made by or under the authority of SBC of any product or service that embodies, or the manufacture or normal use of which entails the use of, all or any part of such Background Intellectual Property (if "none" so state):

3. Project Intellectual Property.

(a) "Project Intellectual Property" means the legal rights relating to inventions (including Subject Inventions as defined in 37 CFR §401), patent applications, patents, copyrights, trademarks, mask works, trade secrets and any other legally protectable information, including computer software, first made or generated during the performance of this STTR Agreement.

(b) Except as otherwise provided herein, ownership of Project Intellectual Property shall vest in the party whose personnel conceived the subject matter, and such party may perfect legal protection in its own name and at its own expense. Jointly made or generated Project Intellectual Property shall be jointly owned by the Parties unless otherwise agreed in writing. The SBC shall have the first option to perfect the rights in jointly made or generated Project Intellectual Property unless otherwise agreed in writing.

(1) The rights to any revenues and profits, resulting from any product, process, or other innovation or invention based on the cooperative shall be allocated between the SBC and the RI as follows:

SBC Percent: _____ RI Percent: _____

(2) Expenses and other liabilities associated with the development and marketing of any product, process, or other innovation or invention shall be allocated as follows: the SBC will be responsible for _____ percent and the RI will be responsible for _____ percent.

(c) The Parties agree to disclose to each other, in writing, each and every Subject Invention, which may be patentable or otherwise protectable under the United States patent laws in Title 35, United States Code. The Parties acknowledge that they will disclose Subject Inventions to each other and the Agency within two months after their respective inventor(s) first disclose the invention in writing to the person(s) responsible for patent matters of the disclosing Party. All written disclosures of such inventions shall contain sufficient detail of the invention, identification of any statutory bars, and shall be marked confidential, in accordance with 35 U.S.C. §205.

(d) Each party hereto may use Project Intellectual Property of the other nonexclusively and without compensation in connection with research or development activities for this STTR project, including inclusion in STTR project reports to the AGENCY and proposals to the AGENCY for continued funding of this STTR project through additional phases.

(e) In addition to the Government's rights under the Patent Rights clause of 37 CFR §401.14, the Parties agree that the Government shall have an irrevocable, royalty free, nonexclusive license for any governmental purpose in any Project Intellectual Property.

(f) SBC will have an option to commercialize the Project Intellectual Property of RI, subject to any rights of the Government therein, as follows—

(1) Where Project Intellectual Property of RI is a potentially patentable invention, SBC will have an exclusive option for a license to such invention, for an initial option period of _____ months after such invention has been reported to SBC. SBC may, at its election and subject to the patent expense reimbursement

provisions of this section, extend such option for an additional _____ months by giving written notice of such election to RI prior to the expiration of the initial option period. During the period of such option following notice by SBC of election to extend, RI will pursue and maintain any patent protection for the invention requested in writing by SBC and, except with the written consent of SBC or upon the failure of SBC to reimburse patenting expenses as required under this section, will not voluntarily discontinue the pursuit and maintenance of any United States patent protection for the invention initiated by RI or of any patent protection requested by SBC. For any invention for which SBC gives notice of its election to extend the option, SBC Will, within _____ days after invoice, reimburse RI for the expenses incurred by RI prior to expiration or termination of the option period in pursuing and maintaining (i) any United States patent protection initiated by RI and (ii) any patent protection requested by SBC. SBC may terminate such option at will by giving written notice to RI, in which case further accrual of reimbursable patenting expenses hereunder, other than prior commitments not practically revocable, will cease upon RI's receipt of such notice. At any time prior to the expiration or termination of an option, SBC may exercise such option by giving written notice to RI, whereupon the parties will promptly and in good faith enter into negotiations for a license under RI's patent rights in the invention for SBC to make, use and/or sell products and/or services that embody, or the development, manufacture and/or use of which involves employment of, the invention. The terms of such license will include: (i) payment of reasonable royalties to RI on sales of products or services which embody, or the development, manufacture or use of which involves employment of, the invention; (ii) reimbursement by SBC of expenses incurred by RI in seeking and maintaining patent protection for the invention in countries covered by the license (which reimbursement, as well as any such patent expenses incurred directly by SBC with RI's authorization, insofar as deriving from RI's interest in such invention, may be offset in full against up to _____ of accrued royalties in excess of any minimum royalties due RI); and, in the case of an exclusive license, (iii) reasonable commercialization milestones and/or minimum royalties.

(2) Where Project Intellectual Property of RI is other than a potentially patentable invention, SBC will have an exclusive option for a license, for an option period extending until _____ months following completion of RI's performance of that phase of this STTR project in which such Project Intellectual Property of RI was developed by RI. SBC may exercise such option by giving written notice to RI, whereupon the parties will promptly and in good faith enter into negotiations for a license under RI's interest in the subject matter for SBC to make, use and/or sell products or services which embody, or the development, manufacture and/or use of which involve employment of, such Project Intellectual Property of RI. The terms of such license will include: (i) payment of reasonable royalties to RI on sales of products or services that embody, or the development, manufacture or use of which involves employment of, the Project Intellectual Property of RI and, in the case of an exclusive license, (ii) reasonable commercialization milestones and/or minimum royalties.

(3) Where more than one royalty might otherwise be due in respect of any unit of product or service under a license pursuant to this Agreement, the parties shall in good faith negotiate to ameliorate any effect thereof that would threaten the commercial viability of the affected products or services by providing in such license(s) for a reasonable discount or cap on total royalties due in respect of any such unit.

4. Follow-on Research or Development.

All follow-on work, including any licenses, contracts, subcontracts, sub licenses or arrangements of any type, shall contain appropriate provisions to implement the Project Intellectual Property rights provisions of this agreement and insure that the Parties and the Government obtain and retain such rights granted herein in all future resulting research, development, or commercialization work.

5. Confidentiality/Publication.

(a) Background Intellectual Property and Project Intellectual Property of a party, as well as other proprietary or confidential information of a party, disclosed by that party to the other in connection with this STTR project shall be received and held in confidence by the receiving party and, except with the consent of the disclosing party or as permitted under this Agreement, neither used by the receiving party nor disclosed by the receiving party to others, provided that the receiving party has notice that such information is regarded by the disclosing party as proprietary or confidential. However, these confidentiality obligations shall not apply to use or disclosure by the receiving party after such information is or becomes known to the public without breach of this provision or is or

becomes known to the receiving party from a source reasonably believed to be independent of the disclosing party or is developed by or for the receiving party independently of its disclosure by the disclosing party.

(b) Subject to the terms of paragraph (a) above, either party may publish its results from this STTR project. However, the publishing party will give a right of refusal to the other party with respect to a proposed publication, as well as a _____ day period in which to review proposed publications and submit comments, which will be given full consideration before publication. Furthermore, upon request of the reviewing party, publication will be deferred for up to _____ additional days for preparation and filing of a patent application which the reviewing party has the right to file or to have filed at its request by the publishing party.

6. Liability.

(a) Each party disclaims all warranties running to the other or through the other to third parties, whether express or implied, including without limitation warranties of merchantability, fitness for a particular purpose, and freedom from infringement, as to any information, result, design, prototype, product or process deriving directly or indirectly and in whole or part from such party in connection with this STTR project.

(b) SBC will indemnify and hold harmless RI with regard to any claims arising in connection with commercialization of the results of this STTR project by or under the authority of SBC. The PARTIES will indemnify and hold harmless the Government with regard to any claims arising in connection with commercialization of the results of this STTR project.

7. Termination.

(a) This agreement may be terminated by either Party upon days written notice to the other Party. This agreement may also be terminated by either Party in the event of the failure of the other Party to comply with the terms of this agreement.

(b) In the event of termination by either Party, each Party shall be responsible for its share of the costs incurred through the effective date of termination, as well as its share of the costs incurred after the effective date of termination, and which are related to the termination. The confidentiality, use, and/or non-disclosure obligations of this agreement shall survive any termination of this agreement.

AGREED TO AND ACCEPTED--

Small Business Concern

By: _____ Date: _____
Print Name: _____
Title: _____

Research Institution

By: _____ Date: _____
Print Name: _____
Title: _____

For assistance in completing your proposal, use this checklist to ensure your submission is complete.

CHECK LIST

1. General

- 1.1 The offeror has read all instructions in this Solicitation and understands that proposals not meeting all requirements may be non-responsive and may not be evaluated.
- 1.2 The offeror understands that proposals must be received by NASA no later than by 5:00 p.m. EDT on May 14, 1998. (Section 6.4.3).
- 1.3 Postal Submission includes the original signed proposal plus three copies. (Section 6.4).
- 1.4 The entire proposal (including any supplemental material) shall not exceed a total of 25 8.5 x 11 inch pages, including Cooperative Agreement(s). (Section 6.4).
- 1.5 The entire proposal must be submitted in the order outlined below. (Section 3.1).

2. Cover Form 9A

- 2.1 The proposal and innovation is submitted for one topic only. (Section 3.3).
- 2.2 Certifications in Form 9A are completed. (Section 3.3.1, 3.5.1)
- 2.3 The period of technical performance does not exceed twelve months and the funding request does not exceed \$100,000. (Section 1.3.3).
- 2.4 Form 9A submitted via Internet (Section 6.3).
- 2.5 Printed Version of Form 9A is signed (Section 6.4) and included in Postal Submission.

3. Summary Form 9B

- 3.1 Form 9B submitted via Internet (Section 6.3).
- 3.2 Printed Version of Form 9B (Section 6.4) is included in Postal Submission.

4. Technical Proposal

- 4.1 The proposed innovation is described in the first paragraph of the (Section 3.4).
- 4.2 The technical proposal contains all eleven parts in order. (Section 3.4).
- 4.3 Phase-II objectives are discussed (Section 3.4).
- 4.4 Commercial applications potential is discussed. (Section 3.4).
- 4.5 Any pages containing proprietary information are labeled "Confidential Proprietary Material" and kept to the minimum essential for the proposal. (Section 3.4).
- 4.6 The Electronic Technical Proposal was
 - 4.6.1 submitted over the Internet, (Section 6.3) OR
 - 4.6.2 placed on an electronic media and included with the Postal Submission Package. (Section 6.4).

5. Budget Form 9C

- 5.1 Form 9C submitted via Internet (Section 6.3).
- 5.2 Printed Version of Form 9C is signed (Section 6.4) and included in Postal Submission.

6. Cooperative Agreement Letter

- Cooperative Agreement is signed and included in postal submission.